



PIER Energy-Related Environmental Research

Environmental Impacts of Energy Generation, Distribution and Use

Is Efficiency Enough? Towards a New Framework for Carbon Savings in California

Contract #: 500-02-004

Contractor: Lawrence Berkeley National Laboratory

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Principal Investigator: Richard Diamond

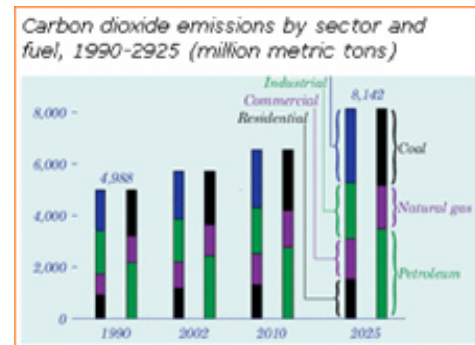
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The Issue

Since the mid-1970s, when California's energy efficiency research and programs began to address increasing energy use, the state's per capita electricity use has increased only slightly. With a population increase of 14 million since the 1970s,¹ however, California's total electricity consumption is now 50% higher than it was in 1980.²

When viewed in the context of what would have occurred in its absence, energy efficiency has helped stem electricity consumption. In doing so, it has also relatively reduced carbon emissions that contribute to climate change, since much of California's electricity supply is generated from fossil fuels. However, energy efficiency definitions are not aimed specifically at reducing absolute levels of carbon emissions, and these emissions continue to grow. Nationwide, residential sector energy-related carbon emissions were 28% higher in 2003 than in 1990.³



www.eia.doe.gov/oiaf/aeo/emission.htm

Such statistics suggest that, relative to carbon emissions-reduction goals, current definitions of residential energy efficiency may not adequately address absolute levels of carbon or other emissions from electricity production. As efficiency increases in almost every realm, the demand for energy services has also been increasing, both through the proliferation of energy-using equipment, and in the residential sector, through the increasing size of equipment and of new homes.

¹ California Department of Finance. Historical California Population Estimates, with Components of Change and Crude Rates, July 1, 1941–2002. Demographic Research Unit.

² Brown, R. E., and J. G. Koomey. 2003. "Electricity use in California: Past trends and present usage patterns." *Energy Policy* 31(9): 851.

³ Energy Information Administration. December 2004. *Emissions of Greenhouse Gases in the United States 2003*. DOE/EIA-0573(2003).

The average size of newly constructed homes in the United States, for example, increased more than 25% from 1975 to 2000.⁴ The increased square footage generally leads to increased demand for energy services per home, both by requiring energy to heat, cool, and light living space, and by creating more space in which to install energy-consuming devices. By attending to absolute consumption and emissions—in addition to traditional definitions of efficiency (whether through modified technical definitions of efficiency or other means)—decision makers will have a better framework to account for greenhouse gas emissions.

Project Description

The Public Interest Energy Research Environmental Area (PIER-EA) funded a project by the Lawrence Berkeley National Laboratory to explore—through data analysis, modeling, literature review, and case studies—the unintended consequences that may result from using an overly narrow concept of energy efficiency as the criterion for designing voluntary programs, incentives, and regulations intended to reduce energy consumption and carbon emissions.

Researchers reviewed the current literature and knowledge on electricity consumption versus efficiency, focusing on policies that affect electricity use in California residences. They conducted case studies for single-family dwellings, residential refrigerators, and residential air conditioning—which were examined to gain a better understanding of the relationships between absolute consumption and nominal efficiency.

Finally, researchers outlined options for an alternative framework, focusing on reducing absolute levels of energy consumption and the resulting carbon emissions from electricity production, and discussed how this framework could be applied to policy and to the design of market transformation and regulatory programs to promote reductions in residential electricity use and, consequently, the impact of carbon emissions in California.

PIER Program Objectives and Anticipated Benefits for California

This project offers numerous benefits and meets the following PIER program objectives:

- **Providing environmentally sound electricity.** Using a framework that addresses total absolute levels of energy use, as well as efficiency, California will be able to better design programs to reduce both energy consumption and carbon emissions.
- **Providing reliable electricity.** Reducing energy consumption will lower electricity demand, which will help increase the reliability of the electricity grid in the state.

Results

The results from this project include both research priorities and general policy recommendations. The research priorities address a host of questions dedicated to refocusing the field's understanding on relationships between consumption, efficiency, and environmental goals. The policy recommendations recognize that there are powerful forces that have shaped current energy use policy to its current form, including a market-based economic system, societal

⁴ Chang, E. February 16, 2003. "And how do we heat those starter castles?" *Washington Post* p. B04.

beliefs about the power of technology to produce solutions, and a political environment that shapes efficiency programs and research. These are not readily overcome, but need to be better recognized if energy policy is to better serve the environment. The researchers' policy recommendations focus on identifying directions that the energy policy and research community might tackle together. These recommendations are to:

- find ways to integrate absolute consumption into technical and political definitions of efficiency,
- attend to the social messages of energy efficiency communications,
- broaden the definition of “environment” in stating the costs of energy use and the benefits of energy efficiency,
- reconsider the stereotype of “consumer” and better ensure that the information given to the public is relevant and fair,
- pay more attention to data, data quality, uncertainty, and trends, and
- develop a more open, critical, perspective on the benefits and limitations of energy policy and the assumptions on which they are based.

Final Report

The final report for this research, *Is Efficiency Enough? Towards a New Framework for Carbon Savings in California* (CEC-500-2005-162), is available on the California Energy Commission's website, at www.energy.ca.gov/pier/final_project_reports/CEC-500-2005-162.html.

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